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HOUSE DUST MITES SENSITIZATION ASSOCIATED WITH SOME ALLERGIC DISORDERS IN BENHA, EGYPT

By

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ABSTRACT

One of the most important etiological factors of allergies was mites occurring in the closest vicinity of humans, i.e. in the house dust and in the stored foodstuffs. The aim of present study was to detect house dust mites sensitization among different types of allergic patients. A cross-sectional study was undertaken on 80 individuals, sixty cases suffering from different forms of allergy and 20 control individuals. Allergy was diagnosed by Skin prick test (SPT) using standard extracts of *Dermatophagoides pteronyssinus, Dermatophagoides farinae.* Serm samples were also examined to determine total IgE and specific IgE for house dust mites (HDM) mixed antigens. The total number of *D. farinae* sensitive cases was 21(26.5%) while the total number of *D. pteronyssinus* sensitive cases was 18(22.5%) with high significant difference between cases and controls. In the present study, (60%) of allergic rhinitis cases, (65%) of asthmatics, (75%) of atopic dermatitis cases and (5%) of controls were positive to HDM specific IgE. There was a significant correlation between total IgE and house dust mites mix specific IgE and there was high significant correlation between SPT results for both *Dermatophagoids* antigens and house dust mites mix specific IgE among the studied groups. There was no significant association between potentially supposed risk factors and allergy except patients with positive family history. Our results further confirm the association between HDM and allergy. Specific IgE assay for measurement of dust mite allergens demonstrated very good analytical characteristics for routine laboratory use.

INTRODUCTION

It was estimated that at least one-fifth of the world's population suffers from allergic diseases. Different factors contribute to the development of allergies; a predisposing genetic background is needed; however, environmental factors play an important role, among them is the exposure to infectious agents (Bruschi et al. 2013).

One of the most important etiological factors of allergies are mites occurring in the closest vicinity of humans, i.e. in the house dust and in the stored foodstuffs. The most important are the species representing the families: *Pyroglyphidae* (mainly The European house dust mite (*Dermatophagoides pteronyssinus*) and the American house dust mite (*Dermatophagoides farinae*) are two different species, but are not necessarily confined to Europe or North America; a other species include *Euroglyphus maynei Glycyphagidae (e.g. Lepidoglyphus destructor, Blomia sp.)*, and *Acaridae (e.g. Tyrophagus putrescentiae, Acarus siro*) also exist (Henszel and Kuzna-Grygiel 2006).

House dust mites are creatures which are so small that they cannot be seen with the naked eye. They live in all our homes and feed mainly on the scales of skin that we shed. They are most common in warm, damp areas where dust containing skin scales gathers. These areas include pillows, mattresses, carpets, soft furnishings, soft toys and even clothing.

Allergy to house dust mites is very common and can trigger allergic reactions such as asthma, eczema and rhinitis. House dust mite (HDM) sensitization affects more than 15–20% of the population of industrialized countries (Zock et al. 2006). Cutting down mite numbers may reduce these reactions. House dust mites (HDMs) are one of the most common sources of allergy worldwide and the major cause of allergic sensitization in asthmatics (Thomas et al. 2010).

House dust mite (HDM) sensitization affects more than 15–20% of the population of industrialized countries (Zock et al. 2006). The medical effects and molecular processes underlying HDM allergy have grown extensively in the recent decades; as a result, diagnosis and immunotherapy have remarkably improved (Thomas 2012).

In this study, we analyzed the clinical and laboratory results from patients suffering from allergy

SUBJECTS AND METHODS

Study design and patient selection

This is a cross-sectional study carried out on cases suffering from different forms of allergy attending Pediatrics, Chest, ENT and Dermatology outpatients clinics in Benha University, Chest and educational Hospitals. The specimens were examined at Department of Parasitology, Faculty of Medicine, Benha University. Cases were divided into 4 main groups: Group 1 includes 20 allergic rhinitis patients; Group 2: 20 asthmatic patients; Group 3: 20 patients with atopic dermatitis or chronic eczema and Group 4 (control group): twenty cases free of present history or clinical manifestation of previous types of allergy.

Clinical Assessment

The demographic data of patients including; age, sex, disease duration and drug intakes, education, occupation, residence, type of housing and family history of allergy were reviewed. All subjects were informed about the process of SPT and given the written consent prior to the testing.

Skin prick test (SPT)

SPT was performed by placing a drop of HDM allergen solution (Allergopharma TM Skin Prick Testing

Kits, Reinbeck, Germany) on the inner side of forearm. The solution was allowed to enter the skin using a needle. Saline and histamine phosphate (10 mg/mL) were used as negative and positive controls, respectively. Short-acting antihistamine was avoided at least 3 days prior to SPT, and long-acting antihistamines or immunosuppressants were withdrawn at least one month before the test. The skin response was measured at 30 minutes after pricking. The degrees of the positivity in SPT were assessed and graded on a scale of 0, 1+, 2+ and 3+, by comparing the size of wheal (mean wheal diameter, MWD) induced by HDM allergen with that induced by 10 mg/mL histamine solution (Ronchetti et al. 2003). Grade 0 = the allergen-induced mean wheal diameter (aiMWD) is smaller than 1/2 of positive control-induced mean wheal diameter (pciMWD); grade 1 (1+) = aiMWD is equal or greater than 1/2, but smaller than 2/3 of pciMWD; grade 2 (2+)= aiMWD is equal or greater than 2/3 of pciMWD but smaller than pciMWD; grade 3 (3+)= aiMWD is equal or greater than pciMWD. In this study, grade 0 was judged as negative, and grades 1 to 3 were judged as positive (Song et al. 2013)

Detection of serum, total and specific IgE

Detection of total IgE was done using AccuBind ELISA Total IgE assay. It is an enzyme immunoassay (ELISA) for the quantitative determination of IgE antibodies in human serum or plasma. HDM-specific IgE level was measured in serum by using RIDASCREEN® Specific EAST IgE-Test (Enzyme Allergo Sorbent Test) for determination of circulating allergen-specific Immunoglobulin E (IgE) in human serum. according to the manufacturer's Instructions. In the present study detection of dust mites mixed antigens specific IgE for (*Dermatophagoides pteronyssinus, Dermatophagoides farina, Acarus siro, Lepidoglyphus destructor* and *Trophagus putrescentiae).*

Ethical Considerations

The present study was approved by the Ethical Committee of Faculty of Medicine, Benha University, Egypt. Written informed consent was obtained from all parents or the legal guardians of the children participating in the study.

Statistical design:

The collected data tabulated and analyzed using SPSS version 16 software (SPSS Inc., Chicago, ILL Company). Data presented as number and percentages. Chi square test (X2) or Fisher's exact test used as a test of significance

RESULTS

Results are summarized in (Tables 1-7). Analysis of the socio-demographic profile of examined cases showed highly statistical significant difference among patients complaining of positive family history for allergy from other groups (Tables 1,2) as Family history of allergy for allergic and control groups showed that out of 20 allergic rhinitis cases, 20 asthma, 20 atopic dermatitis cases and 20 control there were 16 (80%), 10 (50%), 14 (70%) and 5 (25%) with family history of allergy with total of (40/60 cases) high statistical significant difference between the studied groups (P value 0.003).

The age groups with allergy were: children less than five years old (10.0%),

between 5- and 15 years (36.2%), while those > 15 years old was (53.8%)(with the mean age of 24.54±20.06) (Table 2) . In relation to sex, allergy was slightly more in females- 38/60 cases in comparison to males- 22/60. allergy was also higher in cases from rural (34/60) than urban ((14/60) and semi-urban areas (12/60).

Results of the skin prick test:

In the present study, out of 20 allergic rhinitis, 20 asthma, 20 atopic dermatitis patients; eight cases (40%), seven cases (35%), six cases (30%) and 0 cases (0%) were sensitive to *Dermatophagoids farine* antigen on skin prick test respectively, while all controls, were negative. The total number of *Dermatophagoids farine* sensitive cases was 21 (26.5%). There was high significant difference between cases and control (Table 3). The total number of *Dermatophagoids pteronyssus* sensitive cases was 18 (22.5%). Eight cases (40%) of allergic rhinitis group, 6 cases (30%) of asthma group, 4 cases (20%) of atopic dermatitis group were sensitive *Dermatophagoids pteronyssus* antigen on skin prick test. There was high significant difference between examined groups (Table 3).

Results of immunological tests:

a. Results of serum total IgE

The mean of total IgE was higher among the three studied allergic cases than in controls. In the tested allergic cases, the mean of total IgE was much higher in asthmatics (288.85 IU/ml) followed by atopic dermatitis (243.5 IU/ml), while the least was allergic rhinitis group (196.08 IU/ml) (Table 4). There was statistically significant difference between the studied groups.

b. Results of house dust mites specific IgE.

The level house dust mites specific IgE was also higher among the three studied allergic cases than in controls. house dust mites specific IgE positivity washigher in atopic dermatitis cases (15/20) while nearly equal in the other two groups. (Table 5). Relation between & the house dust mites specific IgE with both total IgE and skin prick test statistically significant (tables 6-7) respectively.

DISCUSSION

House dust mites produce powerful enzymes that are strong enough to break down delicate cells, then go on to enter the body, a bit like an invasion. For some people this invasion causes a reaction, while in others, just unwanted dirt that gets cleaned up naturally may occur. Hypersensitivity to house dust mite (*Dermatophagoides* spp.) allergens is one of the most common allergic responses. House dust mite allergens are danger signals for the skin. In addition, HDM-induced activation of the NLRP3 inflammation, some may play a pivotal role in the pathogenesis of atopic dermatitis (Dia et al. 2011).

Although many studies dealing with the association between house mite and allergy in Egypt, only few ones have been carried in Benha to evaluate this association and to determine the value of IgE and skin prick test as an analytical characteristics for diagnosis. In the present study, allergy was common among adults (> 15 ys than younger children) except for asthmatics as most of allergic rhinitis cases (75%) were at age group above 15 years, while most asthma cases

Table (1): Family history of allergy among allergic cases and controls

Family history	Allergic rhinitis		Asthma		Atopic dermatitis		Control		Total		X2 test	P value
	No	%	No	%	No	%	No	%	No	%		
Positive	16	80.0	10	50.0	14	70.0	5	25.0	45	56.2	14.27	0.003 HS
Negative	4	20.0	10	50.0	6	30.0	15	75.0	35	43.8		
Total	20	100.0	20	100.0	20	100.0	20	100.0	80	100.0		

Table (2): Subject characteristics of allergic patients and controls according to age (in years), sex and residence.

		Allergic rhinitis (n = 20)		Asthma (n = 20)		Atopic dermatitis (n = 20)		Control (n = 20)		Total (n = 80)	
		No	%	No	%	No	%	No	%	No	%
Age	<5	1	5	0	0	7	35	0	0	8	10.0
	5-15	4	20	12	60	6	30	7	35	29	36.2
	>15(adult)	15	75	8	40	7	35	13	65	43	53.8
	Mean± SD	26.9±15.03		27.2±25.14		14.0±16.4		30.05±19.62		24.54±20.06	
Sex	Male	8	40	8	40	6	30	9	45	31	38.8
	Female	12	60	12	60	14	70	11	55	49	61.2
Residence	Rural	8	40	15	75	11	55	10	50	44	55.0
	Semi urban	4	20	4	20	4	20	5	25	17	21.2
	Urban	8	40	1	5	5	25	5	25	19	23.8

Table (3): Results of the skin prick test by *Dermatophagoids Pteronyssus* (Der f) antigen and *Dermatophagoids Farine* (Der f) antigen among cases and controls

Skin test			Allergic rhinitis (n=20)		Asthma (n=20)		Atopic dermatitis (n=20)		Control (n=20)		Total (n=80)		X2 test	P value
			No	%	No	%	No	%	No	%	No	%		
Der f	Positive		8	40.0	7	35.0	6	30.0	0	0.0	21	26.2	12.2	0.006 HS
	Negative		12	60.0	13	65.0	14	70.0	20	100.0	59	73.8		
Der p	Positive		8	40.0	6	30.0	4	20.0	0	0.0	18	22.5	11.36	0.008 HS
	Negative		12	60.0	14	70.0	16	80.0	20	100.0	62	77.5		

Table (4): Results of the mean & standard deviation (SD) of serum total IgE level by ELISA test among cases and controls

Variable	Groups	Range	Mean± SD	F test	P value
Total IgE	Allergic rhinitis	15-450	196.08±180.08	3.64	0.016 S
	Asthma	40-460	288.85±169.47		
	Atopic dermatitis	30-450	243.5±159.63		
	Control	25-260	135.5±90.1		

Table (5): Results of the house dust mites specific IgE by EAST test (Enzyme Allergo Sorbent Test) among cases and controls.

House dust mites specific IgE	Allergic rhinitis		Asthma		Atopic dermatitis		Control		Total		X2 test	P value
	No	%	No	%	No	%	No	%	No	%		
Positive	12	60.0	13	65.0	15	75.0	1	5.0	41	51.2	25.77	0.001 HS
Negative	8	40.0	7	35.0	5	25.0	19	95.0	39	48.8		
Total	20	100.0	20	100.0	20	100.0	20	100.0	80	100.0		

Table (6): Relation between total IgE & the house dust mites specific IgE among cases and controls.

Variable	House dust mites specific IgE	Mean	± SD	Student t test	P value
Total IgE	Positive	257.45	170.3	2.428	0.018 S
	Negative	172.38	140.9		

Table (7): Relation between the house dust mites specific IgE & skin prick test results among cases and controls.

House dust mites IgE / Skin test		Positive		Negative		Total		x2 test	P value
		No	%	No	%	No	%		
Der f	Positive	20	48.8	1	2.6	21	26.2	41.78	0.001 HS
	Negative	21	51.2	38	97.4	59	73.8		
Der p	Positive	18	43.9	0	0.0	18	22.5	41.74	0.001 HS
	Negative	23	56.1	39	100.0	62	77.5		

(60%) were at age group 5-15 years, this corroborates finding by other researchers who reported that the common age of asthmatic groups studied were those of the school age (from 5 up to 15 years)(EI-Naggar 1994; Shoeib 2000). This may be attributable to their exposure to the outer environment and their increased outdoor activity. On the other hand, Haroun (2008) studied asthmatic children and found that most patients with asthma were below or equal to 5 years old (63.3 %) while (36.7 %) were more than 5 years old. Similarly, Chang et al (2013) studied children with acute and chronic urticaria, and found the mean age to be 6.39 ± 4.04 years in the acute group and 9.70 ± 4.88 years in the chronic group. The disparity between different studies could be attributed to many factors including variation in selection of the enrolled study population, the sensitivity of the used diagnostic technique or the skill of the investigator. The finding recorded in the present study emphasizes the former interpretation.

The current data also confirmed that, most of allergic cases were residing in rural areas. Many studies reported association between allergy and residence, Shoeib (2000) showed that, most of the houses of asthmatics infested with mites were located in rural areas (54%) as in rural houses, there are more occupants shedding more skin scales, moreover increasing the humidity. In addition to the presence of household pets and birds. On contrary, Haroun (2008) found asthma to be more prevalent in urban (64.6%) more than rural communities (35.3%). This difference may be due to different study design and special factors related to particular population and environmental conditions.

Allergic disorders have reported to be more common in females (38/60) than in male allergic individuals (22/60). Analysis of the socio-demographic profile of examined cases showed highly statistical significant difference among patients complaining of positive family history for allergy as most of cases (40/60) gave positive history. This finding is similar to the report of Bemanian, et al. (2012) who found that, (50.5%) of studied allergic rhinitis patients gave positive family history of atopy.

Skin prick test is an effective diagnostic tool to detect IgE mediated type I allergic reactions such as urticaria, allergic rhinitis and atopic asthma. In this work, the total number of *Dermatophagoids farine* sensitive cases was 21 (26.5%), while 18 (22.5%) of cases were sensitive to *D. pteronyssinus*. This was consistent with a previous report done in Tehran (SPTs for Der p and *Der f* were found to be 25% and 24.1%, respectively) by Mesdaghi et al (2005) *and (*Der p and Der f in patients with allergic rhinitis were 25.3% and 22.9%, respectively *)* Ghaffari et al (2010). A higher results were obtained by Shoeib *(2000*) who found that, the incidence of different allergen sensitivity among asthmatic children was: house dust mite *(D. farinae)* (47.5%), house dust mite *(D. pteronyssinus* (32.5%). Rasool et al (2013) also reported SPT sensitivity to HDM to be 46% Allergic rhinitis and 32% asthma patients. On the other hand, Bemanian, et al (2012) found that SPT sensitivity for *D. pteronyssinus* to be (8.4%) and *D. farinae* sensitization was (7.4%). This variation may be contributed to many factors as skin test reactivity depends on at least three separate factors: (1) an intact immune system; (2) the presence of

IgE sensitized mass cells that release mediators when exposed to antigen; (3) and skin that can respond to histamine with the development of inflammatory response including erythema and induration. The surroundings in our part of world are highly enriched with natural flora. The patterns of aeroallergens in the environment differ widely in different localities and seasonal changes (particularly when they affect pollen) are important. In addition, mites grow in areas with high humidity and moderate temperature, so sensitization is high in these areas but low in hot dry desert areas

A variety of clinical allergy markers have been utilized, specific and total IgE measured by skin or serological testing, assess sensitization as well as exposure to environmental antigens and frequently are used to determine the prevalence of allergic responsiveness.

This study supports what was found by Nyan et al (2001), Haroun (2008), and (Li et al., 2011) who found that atopic subjects(allergic rhinitis, asthmatics) had total serum IgE concentrations higher than the upper limit of the reference range in non-atopic

Higher serum levels of total IgE and IgE specific to house dust mites were observed in self-reported past-wheezers with AHR relative to those without AHR (Yoshikawa and Kanazawa 2012). In the present study, there was a significant correlation between total IgE and house dust mites mix specific IgE and there was high significant correlation between skin prick test results for both *D. pteronyssinus* and *D. farinae* antigens and house dust mites mix specfic IgE among the studied cases and controls. An increased level of total IgE implies a larger risk for sensitization to other agents, as evidenced by the high prevalence of sensitization to HDM. More than 80% of the studied children were sensitized to *D. pteronyssinus* (Su et al. 2005).

Seoung et al (2010) found that High total IgE group showed significantly higher positive rates and number of positive allergen specific IgEs in all of the 3 test kits used compared to low total IgE group. Only two of the allergens, *D. pteronyssinus* and *D. farinae* had positive concordance rates of ≥ 50%. Allergen specific IgEs to these two allergens showed good correlation with total IgE (correlation coefficients >0.5).

Level of serum HDM-specefic IgE was also positively correlated with total IgE. An increasing specific IgE level was correlated with higher SPT grades in both *D. pteronyssinus* and *D. farinae* Meanwhile, the correlation coefficient exhibited an increase in value with aging, and the 31- to 40-year age group demonstrated the highest value for both *D. pteronyssinus* and *D. farinae* (Zhang et al. 2011).

Conflict of Interest: The authors declare that they have no conflict of interest.

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ترافق حساسيه حلم غبار البيت مع بعض الاضطرابات التحسسيه فى مدينه بنها

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[٣]قسم علم الحيوان كليه العلوم جامعه بنها

يعتبر حلم الغبار واحدا من أهم مسببات الحساسية للانسان خاصة في الاماكن المغلقة مثل غبار المنزل وفي المواد الغذائية المخزنة. وكان هدف الدراسة الحالية الكشف عن حساسية حلم الغبار المنزلي بين انواع مختلفة من مرضي الحساسية. وأجريت الدراسة علي ٨٠ شخصا منهم ستون حالة تعاني من أشكال مختلفة من الحساسية بالإضافة إلي عشرون شخص سليم كمجموعة ضابطة. تم تشخيص الحساسية باستخدام إختبار وخز الجلد (SPT) باستخدام مستخلصات قياسية لكل من ديرماتوفاغويدس بتيرونيسينوس(*D. pteronyssinus*)، ديرماتوفاغويدس فاريناي (D. farinae). كما تم فحص عينات السيرم لتحديد الجلوبيولين المناعي إي (IgE) سواءا الاجمالي او المحدد لكل نوع.

كان العدد الاجمالي للحالات المصابة بحساسية *D. farinae* (٢٦.٥٪) في حين كانت نسبة الحالات المصابة بحساسية D.*pteronyssinus* (٢٢.٥٪) مع وجود الحالات فرق كبيربين الحالات والضوابط. في الدراسة الحالية، (٦٠٪) من حالات حساسية الأنف، (٦٥٪) من مرضى الربو، (٧٥٪) من حالات التهاب الجلد وكذلك.(٥٪) من والضوابط كانت إيجابية HDM المحدد .IgE الضوابط كانت ايجابىللغلوبولين المناعي (IgE) و حلم الغبار المنزلي (إيغ) و كان هناك ارتباط معنوي كبير بين نتائج SPT لكل من مستضدات ديرماتوفاغوادس و عث غبار المنزل يخلط إيغ معين بين المجموعات المدروسة. لم يكن هناك ارتباط كبير بين عوامل الخطر المحتملة المفترضة والحساسية باستثناء المرضى الذين لديهم تاريخ عائلي إيجابي. نتائجنا تؤكد كذلك العلاقة بين حلم الغبار المنزلي والحساسية. فحص الجلوبيولين المناعي اي (IgE) المحدد لقياس حساسية حلم الغبار أظهرت خصائص تحليلية جيدة جدا للاستخدام المختبري الروتيني.

١٢. المجلة المصرية للعلوم الطبية ٣٧(٢) ديسمبر ٢٠١٦: ٧٠٥–٧١٨.